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ABSTRACT

This document is a source book for those who see the need to provide more meaningful mathematical experiences for students who have experienced little or no success in traditional programs. It is in four parts. In the first part, three innovative general mathematics projects are described. The second part outlines the mathematics laboratory approach, lists four books on the topic and gives some sources of activity packages, mathematical games and other equipment. The third part describes six courses for slow achievers which are available commercially, and the last part is a select bibliography on the low achiever. (MM)

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developing programs for SLOW and DISENCHANTED learners of mathematics

SE 012 461

State of Montana
Office of the Superintendent of Public Instruction
Dolores Colburg, Superintendent
Helena 59601

To: Mathematics Educators

From: Alan D. Nicholson, Mathematics-Science Supervisor

Re: Mathematics Programs for Slow and Disenchanted Learners

The information contained in this document is offered in the hope that it will be helpful to those who see the need to provide more meaningful mathematical experiences for students who have experienced little or no success in traditional programs. Your school may wish to adopt a recent innovative project or you may want to devise a program of your own using a developed project to guide and supplement your work. You may even decide to build a program of your own design. Whatever your choice might be, the ideas contained herein are intended to suggest alternatives rather than prescribe courses of action.

In the experience of others, success in extending new and worthwhile mathematical experiences to students depends upon the willingness of the school community to make a documented commitment to such a project. Such a commitment must involve students, administrators, boards (and perhaps even communities) as well as teachers in both planning and implementation. Such a commitment must not be made without considering local problems and without utilizing the experiences of the local planners. It is imperative, however, that planners educate themselves to the thinking and experiences of educators, mathematics educators and mathematicians through reading what these persons have to say on the topic or through direct contact with them if that is possible. Every precaution should be taken to prevent the mere replacement of old dogma with new dogma. Constant evolution of philosophy and technique must be provided as the need for change becomes apparent. Finally, the commitment must provide for the preservation of the dignity and integrity of the students and adults involved.

For those institutions willing to make a commitment to the improvement of mathematics education for students typically labeled slow or reluctant learners, this document may be of some help. Schools searching for panaceas and "easy answers" will have to look elsewhere. Every attempt will be made by the Office of the Superintendent of Public Instruction through the Supervisor of Mathematics and Science to provide assistance to those who desire it.

INNOVATIVE GENERAL MATHEMATICS PROJECTS

A number of interesting and potentially worthwhile curriculum projects for the development of philosophies and materials related to the education of low achieving mathematics students have recently begun. For the most part they have been funded by the U. S. Office of Education or by an ESEA Title III grant. A brief description of three such programs in our area follows.

There has been a general sharing of resources and ideas among the three experimental projects described below. In each case, emphasis is put on the dignity and responsibility of the learner as he is given the opportunity to learn mathematics at his own rate in his own way. In all projects, the laboratory approach is predominant.

Developers are reluctant to supply only the materials which accompany their programs because they feel that it is the philosophy of their program, with all that implies about student-teacher relationships, learning theories, etc., which is really the important part and which will ultimately bring about the changes necessary to provide better mathematics for low achieving students. They do, however, welcome your comments and inquiries and stand ready to do what they can to help schools develop meaningful programs for low achieving mathematics students.

Butte Title III Ninth Grade General Mathematics Program

In an attempt to provide an environment for general mathematics students in which the "learner can be educated in his own right and to the maximum of his ability," the developers of the Butte project have decided to reject a traditional academic program in favor of a more open laboratory approach. Mathematical skills on four progressive levels have been stated and various instructional modes have been identified to allow students to acquire each of these skills. The skills deal with the ability to demonstrate the use of arithmetic operations of varying complexity, the understanding of certain geometric concepts and the development of a variety of other mathematical notions. The instructional modes include the use of manipulative and concrete materials, simulation activities, math games and puzzles, physical involvement activities, worksheets dealing with consumer and business problems, textbooks and a variety of printed materials and hardware such as slide rules and calculators.

Students are encouraged to work individually or in small groups on activities which will help fulfill their needs as seen by themselves and their teachers. Diagnostic evaluations are made to help determine what activities each student should pursue. The developers have stated their belief in the following precepts, among others.

1. Achievement of slow learners must be measured in terms of individual growth.
2. The activities of the slow learner must be varied because of his attention span.
3. Concrete presentations must be emphasized.
4. A spiral development of topics is essential.
5. Subject matter must be correlated with work in other classes whenever possible.
6. Practical applications should be included.
7. The slow learner does best in a laboratory type setting.
8. The teacher is the key to any program. If he believes the slow learner can do it, the program is likely to be successful.

Finally it is hoped that the following objectives can be achieved:

1. To develop a positive attitude in the student toward the learning of mathematics;

2. To offer students mathematical experiences that are relevant to their needs and abilities so that there will be significant increase in mathematical achievement.

William Connors, Director
Butte Title III General Mathematics Project
Butte Public Schools
Administration Office
111 North Montana Street
Butte, Montana 59701

COLAMDA: COMMITTEE ON LOW ACHIEVERS IN MATHEMATICS--DENVER AREA

This project is designed to "provide an opportunity for teachers to explore, experiment, exchange ideas and prepare materials for low achieving math students grades 7-12." The philosophy of the program as stated by developers is as follows:

"In the ferment of changes in mathematics education, the low achieving math student has been by-passed. He is still a potential drop-out of our public schools, passing time in courses unsuited for his needs and desires. At the same time when new courses and experimental projects for the college bound student continue to develop, more students are leaving school before graduation than ever before.

"One of the major concerns of this project is for the teachers to learn from the learners how to teach, and thus, be able to teach the learner how to learn about himself and the world around him.

"Little or no professional status is associated with teaching a basic or general mathematics class. This lack of pride or prestige has caused both students and teachers to be without sufficient interest, ambition or desire to exert the necessary effort to make a program a desirable learning situation. Because of such a situation and a concern for improving the curricula the COLAMDA Project was born.

"The student is encouraged to complete assignments at his rate of learning and problem solving. A student is not required to 'work through' problems and/or concepts of which he indicates a high degree of proficiency on a unit pre-test. To develop an atmosphere of 'active involvement' a mathematics laboratory is being developed by each teacher.

"Participating teachers are trying to determine what should be included in their laboratory and the kind of laboratory equipment that should go with the activities. Each participating teacher is encouraged to develop, explore and share ideas, materials, equipment and apparatus conducive of the laboratory experiences. The student is encouraged to develop realistic objectives including an examination of the math skills employers have identified as needed for job skills. Each teacher is encouraged to make visitations to the businesses and industrial locations near the school and obtain problems and employees have difficulty solving, collect data on skills required of a potential employee before he is hired. Each teacher has several released days to search for such data and attend planning meetings.

"There is a continual discussion of new ideas through experimentation, field testing and seminars. Both educator and learner work together to find ways to make education a relevant and exciting experience self-directed growth.

"Materials are being prepared to supplement existing district materials to meet the needs of each of the teacher's classes. The Project materials, as well as teacher prepared materials, are constantly being field tested.

"Evaluation of project activities is in constant operation. For the most part, after the first few months of operation, evaluation procedures are still of the subjective nature. A primary concern of the Project is trying to determine if there has been an attitude change among the teachers as well as the student which is nearly impossible to measure."

Mr. Terry Shoemaker
COLAMDA Project
P. O. Box Q
Castle Rock, Colorado 80104

WYMOLAMP: WYOMING MODEL LOW ACHIEVER MATHEMATICS PROJECT

This project is designed to serve as a statewide model for the development of mathematics programs for low achievers in grades 1-12. The objectives of the project as stated by WYMOLAMP developers are as follows:

1. To develop new strategies and materials for the low achiever in mathematics, grades 1-12;

2. To serve as a training center for teachers who want to use new strategies and materials;

3. To develop occupational mathematics "packets" which include relevant and necessary mathematics skills for the occupational clusters set forth in the Wyoming Comprehensive Occupational Education Program Design.

"On the premise that students learn better by doing than by watching and listening, WYMOLAMP is designed as 'hands-on,' student-interest oriented project, with materials and strategies being planned to complement any mathematics course for low achievers. A variety of manipulative devices, games and interest-catching puzzles coded to student objectives will be available for teaching given mathematics concepts.

"In this first year, Riverton is operating two pilot classes in grades seven and ten, taught by Bob Brush and Michelle Cargan. These classes are using WYMOLAMP skill objectives as the basis for their instruction and will be carefully evaluated throughout the year for achievement growth and attitudinal changes."

The director gives the following admonition: "We don't propose that we have all the answers for low achievers in mathematics. We have some ideas we'd like to share with other mathematics teachers. We welcome inquiries, suggestions and ideas, and believe that together, the teachers of the state can provide a better set of experiences for a very important group of students."

David Flory, Director
WYMOLAMP Project
Riverton, Wyoming 82501

THE MATHEMATICS LABORATORY

The laboratory approach to teaching mathematics is not new but it is receiving renewed attention as educators come to understand the power of this approach to develop new kinds of mathematical awareness, to promote development of traditional mathematical skills and concepts and to foster positive attitudes toward the learning of mathematics.

This approach is being widely advocated for use in mathematics education at all levels but especially in the elementary schools for all children and in the secondary schools for students labeled as slow or reluctant learners. (Perhaps "disenchanted" learners would be a more appropriate term since it confers a heavier responsibility on the curriculum for the student's apparent shortcomings.)

There are many ways to characterize a mathematics laboratory. One of the best is the following description from the Des Moines program.

> "Primarily, a mathematics laboratory is a state of mind. It is characterized by a questioning atmosphere and a continuous involvement with problem solving situations. Emphasis is placed upon discovery resulting from student experimentation. The teacher acts as a catalyst in the activity between students and knowledge.
>
> "Secondarily, a mathematics laboratory is a physical plant equipped with such material objects as calcuators, overhead and opaque projector, filmstrips, movies, tape-recorder, measuring devices, geoboards, solids, graph board, construction devices, [printed materials, math games, puzzles] etc. Since a student learns by doing, the lab is designed to give him the objects with which he can do and learn."

Should your school decide to pursue a mathematics laboratory approach you may wish to order all or some of the following publications.

1. *Freedom to Learn: An Active Learning Approach to Mathematics,* by Edith E. Biggs, James R. MacLean

   Addison Wesley (Canada) Ltd.
   57 Gervais Drive
   Don Mills, Ontario
   CANADA

   The preface states:

   "This book has been written to assist students preparing for a teaching career, experienced teaches, administrators and all others interested in children and education to become more familiar with an active learning approach. In particular, we have tried to use mathematics to describe what distinquishes an active learning approach and how it might be implemented."

2. *The Laboratory Approach to Mathematics,* by Kidd, Myers, Eillay

   Science Research Associates, Inc. (SRA)
   259 East Erie Street
   Chicago, Illinois 60611

This book defines the laboratory approach, gives rationale for its use and has a wealth of ideas for its implementation. "The strongest aspects of this book . . . are the many examples and ideas that can be used in the classroom. Of special interest is the unit . . . that starts an idea from the beginning and outlines it in detail and is consistent throughout with the laboratory approach."

3. *How to Start a Math Lab,* by Donald Cohen, Charlotte Frank, Bernard Kessler

Olivetti Education Center
155 White Plains Road
Tarrytown, New York 10591

This booklet is one of several published by the Olivetti Education Center. It reflects the philosophy that "the most constructive approach for today's teacher is to concentrate on making his pupils aware of *how to learn* rather than what to learn . . . . Children who have been taught to think humanely, creatively and critically will be well equipped to deal with an unknown and rapidly changing world."

4. *A Handbook of Aids for Teaching Junior-Senior High School Mathematics,* by Stephen Krulek ($2.95)

W. B. Saunders Company
West Washington Square
Philadelphia, Pensylvania 19105

This book shows how to use common materials -- such as waxed paper, thread, posterboard and file cards in the mathematics classroom. The devices are intended for student use to allow him to become involved as an active learner. Aids are divided into categories such as arithmetic, algebraic, geometric, etc.

ACTIVITY PACKAGES

The problem of developing a mathematics laboratory and providing for a semblance of individualized instruction to begin to help fulfill the very different mathematical needs of students who come to class with very different backgrounds, abilities and attitudes seems overwhelming at first. Among the many things that might be done to assist in the implementation of the mathematics laboratory, the development of activity packages seems to have promise.

Activity packages, as the name could imply, consist of a number of suggested tasks, the performance of which will hopefully lead to the acquisition of desirable mathematical qualities in the student or the sharpening of skills and concepts. These suggested tasks may be transmitted, for example, on audio tapes. More often they are printed on cards which have come to be known as "activity cards."The activity package may also contain whatever is needed in the way of resources to perform the tasks.

The assignments given to the student on the activity cards may be very prescriptive and closed, giving him little or no latitude to determine what the outcomes of his activities might be. The result of his pursuits will be the same as his neighbor's. On the other hand, the cards might suggest more open-ended investigations which will allow him increased freedom in discovering relationships and which will help challenge and develop his inventive powers. The "openess" or "closure" of the suggested task will depend on the objective of the activity and the ability of the student to cope with structure or the lack of it. Generally, open-ended inquiry is preferable.

Activity packages may be purchased from commercial sources or devised by teachers and students themselves. Development by teachers and students has many advantages, including economy. Excellent commentary on the design and use of activity cards may be found in the publications *Freedom to Learn: An Active Learning Approach to Mathematics* and *How to Start a Math Lab.* Reference is made to both of these publications in the preceding section on Math Labs.

COMMERCIALLY PRODUCED ACTIVITY CARDS AND ACTIVITY PACKAGES

1. *Independent Exploration Material,* by Madison Project, Math Media Division, H + M Associates, Box 1107, Danbury, Connecticut 06810.

2. *Activity Cards for Independent Exploration,* Concept Company, Box 273, Belmont, Massachusetts 02178.

3. *Retriev-o-math Activity Cards,* by Eugene P. Smith and Carlos Wilhite, Midwest Publications Company, Inc., Box 307, Birmingham, Michigan 48012.

4. *Student Activity Cards for Cuisenaire Rods,* by Galton et al Cuisenaire Company of America, Inc., 12 Church Street, New Rochelle, N. Y. 10805.

5. *Mirror Cards,* Problem Cards for the Attribute Games, and other Elementary Science Study Math materials, McGraw-Hill Book Company, Webster Division, Manchester, Missouri 63011.

6. *Green and Red Cards for Grades 6 to 9,* John Wiley & Sons, Nuffield Project, New York, N.Y. 10016.

7. *Geocards,* by Donald Cohen, Walker & Company, 720 Fifth Avenue, New York, N.Y. 10019.

8. *Mathematics Mini-Lab,* by Donald Cohen, SEE, 3 Bridge Street, Newton, Massachusetts 02195.

9. *Tasks and Manual for Use with the Multi-Base Arithmetic Blocks,* by Dienes, Herder & Herder, New York, N.Y. 10016.

10. *The MacMillan Math Activity Cards,* by David Clarkson, MacMillan Company, Toronto, Ontario, CANADA.

11. *Math Lab,* Jack Hood School Supplies Company, Inc., 91-99 Erie Street, Stratford, Ontario, CANADA.

12. *Math Action,* Copp Clark Publishing Company, Montreal, CANADA.

13. *Applied Mathematics Cards,* Schofield & Sims Ltd., 35 St. John's Road, Huddersfield, ENGLAND.

14. *Mathex,* Encyclopedia Britannica Publishers, Ltd., 151 Bloor Street, West, Toronto 5, CANADA.

SOURCES OF MATH LAB EQUIPMENT, MATH GAMES, AND ENRICHMENT MATERIALS
(Catalogs will be sent upon request to publisher)

Concept Catalogs

Concept
Box 273
Belmont, Massachusetts 02178

Creative Publications

Creative Publications
P. O. Box 328
Palo Alto, California 94302

Cuisenaire Aids for Learning Mathematics Catalog,

Cuisenaire Company of America, Inc.
12 Church Street
New Rochelle, New York 10805

Developmental Learning Materials

Developmental Learning Materials
3505 N. Ashland Avenue
Chicago, Illinois 60657

Edmund Catalog

Edmund Scientific Company
300 Edscorp Building
Barrington, New Jersey 08007

Educational Teaching Aids for Early Learning and Special Education

Education Teaching Aids Division
A. Daigger & Company
159 West Kinzie Street
Chicago, Illinois 60610

Ideal, Instructional Materials for Mathematics and Measurement, and *Quality Instructional Materials for all Grades,* and *Milton Bradley Aids for Elementary Mathematics* (4 catalogs)

STAS Instructional Materials, Inc.
2100 Fifth Street
Berkley, California 94710

J. Weston Walch Catalog

J. Weston Walch, Publisher
Box 1075
Portland, Maine 04104

Sources of Math Lab Equipment, Math Games, and Enrichment Materials (continued)

Lakeshore Curriculum Materials

Lakeshore Curriculum Materials Equipment Company
1144 Montague Avenue
Box 2116
San Leandro, California 94577

Math Media Catalog

Math Media Division
H + M Associates
P. O. Box 1107
Danbury, Connecticut 06810

Math and Things (SEE), Inc.

Selective Educational Equipment, (SEE), Inc.
Three (3) Bridge Street
Newton, Massachusetts 02195

Mathematics U.S.A.

Midwest Publications Company, Inc.
P. O. Box 307
Birmingham, Michigan 48012

Secondary Teaching Aids

Math-Master
Division of Gamco Industries, Inc.
Box 1911A
Big Spring, Texas 79720

SRA-Catalog

Science Research Associates, Inc.
259 East Erie Street
Chicago, Illinois 60611

Walker Educational Catalog

Walker Educational Book Corporation
720 Fifth Avenue
New York City, New York 10019

COLAMDA MATH PUZZLES

Cost List

C-4	Two Square Puzzles	.20
E-9	Cross Dissection	.20
E-23	Quadrix	.20
E-24	Reversal	.33
E-28	Garage Shuffle	.35
E-29	Square-One	.20
E-30	Dissected T	.20
E-31	Dissected E	.20
E-43	Dissected E2	.20
E-37	Star Puzzle	.20
E-12	Center Peg	.33
E-16	Pascal's Leap	.24
E-25	Nim-Line Runner	.35
E-13	Ten Men in a Boat	.14
E-15	Hidding a Twister	.11
E-18	Topo I	.23
E-17	Topo II	.31
E-36	Geo I (1,2,3,4,5,)	.20
C-3	Geo II (A,B,C,D,E,F,)	.20
E-14	Soma Cube	.50
E-26	Hanoi Tower	1.30
E-21	Puzzling Butterflies	.27
C-1	CILAMP Tanagrams	.51
E-27	Dissected Square	.42
E-22	Puzzling Pyramid	.40
E-20	Instant Madness	.32

OTHER

Geoboards - with 25 nails, including bands	.41
Geoboards - with 100 nails, including bands	.51
Cubes will be @	.01½

For further information or orders, please contact:

Mr. Dan Colvin
c/o Dr. Ruth Hoffman
Math Lab
University of Denver
Denver, Colorado 80210
(303) 753-3359

All puzzles come unassembled and unpainted: also postage on all orders *MUST BE PAID BY THE PURCHASER.*

A SELECTIVE ANNOTATED BIBLIOGRAPHY OF RESOURCES FOR THE DEVELOPMENT OF MATHEMATICS PROGRAMS FOR SLOW AND RELUCTANT LEARNERS

1. The UICSM Mathematics Program for grades 7 and 8

   Harper and Row, Publishers, Inc., 1969
   Bryce A. Jackman, Montana Representative
   1165 East Range Road
   Salt Lake City, Utah 84117

   Grade 7: *Stretchers and Shrinkers*
   A four-book program on fractions, decimals, percent. Teacher's edition and activities handbook also are available.

   Grade 8: *Motion Geometry*
   A four-book program designed to directly involve the student in a multisensory approach to basic geometry concepts. An activities handbook, protractors and "magic" mirrors also are available.

   These books utilize the "storyline" approach to create interests and promote mathematical growth. The course has been piloted in many states including Montana and seems to hold much promise. Eastern Montana College has applied for funding to teach the use of these UICSM materials to teachers of teachers in Montana, Wyoming, North and South Dakota.

2. *Key Ideas in Mathematics,* by Gerard, Jones and Foster for Junior High

   Harcourt Brace and Jovanovich, Inc., Publisher, 1970
   Polk and Geary
   San Francisco, California 94109
   (No Montana Representative)

   Key Ideas in Mathematics is also available either as a two-book series or as a complete set of two-color duplicating masters for every lesson in the hardbound textbook. Written for low achievers, reading is kept at a minimum and color, photos and cartoon illustrations are emphasized.

3. *Essentials of Mathematics,* by Sobel, Maletsky and Hill for grades 7-9

   Ginn and Company, 1969
   Jack Baier, Montana Representative
   P. O. Box 1133
   Bozeman, Montana 59715

   This is a series of three textbooks designed to maintain student interest with puzzles, games, experiments, flow charts and brain teasers, all dealing with some aspect of arithmetic, algebra or geometry. The reading is easy and is reinforced by ample and entertaining illustrations.

4. *Individualizing Mathematics* by Foley et al, for grades 7-9

Addison-Wesley Publishing Company, Inc., 1970
Charles J. Drake, Montana Representative
1791 South Valentine Way
Denver, Colorado 80228

1. *Skills and Patterns* grade 7, 12 booklets
   Patterns and Discovery grade 8
   Discovery and Structure grade 9

Each sequence is part of a three-year basal mathematics program and is complete with 12 single topic booklets, diagnostic and achievement tests and activity cards. "The program is designed to be used with below average students with the idea that they progress at their own rate and, perhaps, go on to algebra and more advanced courses."

5. *Activities in Mathematics,* by Johnson et al for grades 7-9

Scott, Foresman and Company, 1971
Robert Jones, Montana Representative
2303 Briggs Avenue
Missoula, Montana 59801

1. First Course: Patterns, Numbers, Measurement and Probability

2. Second Course: Graphs, Statistics, Proportions, Geometry

This program emphazises "work with" materials and math lab activities including individual work and "real-life" illustrations and examples. A student book, a teacher's edition and a book of correlated duplicating masters and overhead visuals are available for each of the eight titles.

6. *Experiences in Mathematical Ideas,* Grades 5-8

National Council of Teachers of Mathematics, Publisher, 1970
1201 Sixteenth Street, N.W.
Washington, D.C. 20036
(No Montana Representative)

Experiences in Mathematical Ideas includes thirteen prototype units:

1. Experiences with Base and Place Value
2. Experiences with Renaming Numbers in Addition and Subtraction
3. Experiences with Physical Models for Multiplication
4. Experiences with Units of Measure
5. Experiences with Physical Models for Fractions
6. Experiences with Physical Models for Decimals
7. Experiences with Tables and Change
8. Experiences with Using Tables to Solve Problems
9. Experiences with Ratio
10. Experiences with Graphs
11. Experiences with Organizing Data
12. Experiences with Dealing with Uncertainty
13. Experiences with Geometry

The first six units are bound in Volume 1, and the remaining seven units are bound in Volumn 2.

The advertising brochure describes this material as follows:

"EMI does not comprise a complete mathematics program for low achievers in grades five through eight. Neither is it intended to be used solely for supplementary or enrichment purposes. Rather, the units offer a model for teaching the representative segments of mathematics which are usually taught to and needed by all students. Most of the units are independent of the others and need not be taught in any specified order nor at certain grade levels.

"EMI is unique in that it provides all the basic materials necessary to enable slow learners to achieve success in learning important representative segments of mathematics. The two volumes containing the thirteen units are a complete guide for the teacher--they include an overview for each unit and give the objectives, list of materials, suggested teaching strategy and means of evaluation for every experience. The accompanying 'Teaching Package' for each volume contains the materials the teacher needs to implement the strategies and is closely correlated with the individual experiences.

"The teaching package materials are printed on 8½ by 11 inch sheets so they can be easily duplicated by the teacher to make (1) overhead-projector transparencies, (2) labels, game materials and other software needed at activity stations, and (3) copies of worksheets for students. These sheets are punched and numbered so the teacher can keep them in order in a notebook or file.

"There are 285 sheets of reproducible materials. All sheets to be distributed to students are shown in reduced size in the teacher's guide, following the suggestions for their appropriate use. Answers are overprinted in color on these reductions.

"The units and associated teaching package materials in the EMI project have been structured to provide new and different learning experiences in mathematics for students who have not achieved from teaching materials and patterns commonly employed."

To order, use the following order form.

Quantity	Stock Number	Title	Each	Total
_____	_____	Experiences in Math Ideas Vol. I	$20	_____
_____	_____	Experineces in Math Ideas Vol. 2	20	_____

Make checks payable to the National Council of Teachers of Mathematics

Name (please print) _____

Address _____

7. *Modern Mathematics for Achievement: First and Second Courses,* by Herrick et al for grades 7-9.

Houghton Mifflin, 1967
Harlan Heydon, Montana Representative
P. O. Box 1060
Spokane, Washington 99210

Each course is divided into eight paperbound booklets on various topics. The approach is inductive with a self-contained testing program and exercises to "assure the day-to-day successes so necessary to motivate low achievers."

ELEMENTARY

8. *Mathematics in Action*, by Kane, Deans, et al, grades 1-8

American Book Company, 1969
James Kelly, Montana Representative
3022 West Decatur
Spokane, Washington 99208

Especially written for average and below average achievers, this non-graded series develops concepts and skills "at a pace significantly slower than that which is found in typical mathematical series today." Units allow considerable flexibility to meet individual student needs.

9. *Essential Modern Mathematics,* Books A-D, by Glennon et al. For intermediate grades

Ginn and Company, 1970
Jack Baier, Montana Representative
P. O. Box 1133
Bozeman, Montana 59715

This program is "designed to meet the mathematical needs, social interests and general learning abilities" of children who are low in achievement in mathematics. The series tries to make a real provision for individual differences by offering relevant and appropriate curriculum changes.

INFORMATION ON LOW ACHIEVERS IN MATHEMATICS

Information for most of the following references was compiled in April, 1970 by John Ogle, Mathematics Consultant with the North Carolina State Department of Public Instruction, Raleigh, North Carolina 27620.

Periodicals

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K. Sasse'. "Mathematics for the Noncollege-Bound in Junior High School," *The Mathematics Teacher* 232-240, March 1965.

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Zimmerman, et al. Lamp Booklet, Gimmicks and other material suitable for use with students in grades 7-10, request bibliography of these materials from Central Iowa Low-Achiever Motivational Project, (CILAMP), 1164 26th Street, Des Moines, Iowa 50311.

Mathematical Reasoning, written by a high school mathematics teacher for her low achieving students with wide ranging abilities in grades 9-12. Contains both discussion, and mathematical units on such topics as logic, critical thinking, probability and mathematical systems. Order catalog containing annotations of other materials from Midwest Publications Company, Inc., P. O. Box 307, Birmingham, Michigan 48012.